



CERTIFICATE

I, the undersigned, Takashi Kiso, residing at 5th Floor, Shintoshicenter Bldg., 24-1, Tsurumaki 1-chome, Tama-shi, Tokyo 206-0034 Japan, hereby certify that to the best of my knowledge and belief the following is a true translation into English made by me of Japanese Patent Application No. 2000-076032 filed on March 17, 2000.

RECEIVED

MAR 26 2004

Technology Center 2100

Dated this 27th day of December 27, 2001

Takashi Kiso

- Takashi KISO

[Name of Document] PATENT APPLICATION  
[Reference Number] 2906415290  
[Filing Date] March 17, 2000  
[To] Commissioner, Patent Office  
[International Patent Classification]

H04B 7/26

[Inventor]

[Address or Residence]

4-3-1, Tsunashimahigashi, Kohoku-ku, Yokohama-shi,  
Kanagawa, Matsushita Communication Industrial Co., Ltd.

[Name] Takashi KITADE

[Inventor]

[Address or Residence]

4-3-1, Tsunashimahigashi, Kohoku-ku, Yokohama-shi,  
Kanagawa, Matsushita Communication Industrial Co., Ltd.

[Name] Kazuyuki MIYA

[Inventor]

[Address or Residence]

4-3-1, Tsunashimahigashi, Kohoku-ku, Yokohama-shi,  
Kanagawa, Matsushita Communication Industrial Co., Ltd.

[Name] Katsuhiko HIRAMATSU

[Inventor]

[Address or Residence]

4-3-1, Tsunashimahigashi, Kohoku-ku, Yokohama-shi,  
Kanagawa, Matsushita Communication Industrial Co., Ltd.

[Name] Osamu KATO

[Applicant for Patent]

[Identification Number]

000005821

[Name] MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.

[Agent]

[Identification Number]

100105050

[Patent Attorney]

[Name] Kimihito WASHIDA

[Claim of Priority based on Prior Application]

[Application Number] Hei JP11-337623

[Filing Date] November 29, 1999

[Agent]

[Identification Number]

100105050

[Patent Attorney]

[Name] Kimihito WASHIDA

[Indication of Official Fee]

[Prepayment Register Number]

041243

[Amount of Payment] Yen 21,000

[List of Items Submitted]

[Name of Item]	Specification	1
----------------	---------------	---

[Name of Item]	Drawing	1
----------------	---------	---

[Name of Item]	Abstract	1
----------------	----------	---

[Number of General Power of Attorney] 9700376

2906415290

[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] COMMUNICATION TERMINAL  
APPARATUS, BASE STATION APPARATUS, AND TRANSMISSION

5 POWER CONTROL METHOD

[SCOPE OF CLAIMS FOR PATENT]

[Claim1] A communication terminal apparatus  
comprising:

despreading means for despreading each of a  
10 plurality of received signals orthogonal to each  
other;

reception power measuring means for measuring  
reception power of the respective despread data;

reception power combining means for combining  
15 the respective measured reception power of data; and

transmission power controlling means for  
controlling transmission power based on the combined  
reception power.

[Claim2] The communication terminal  
20 apparatus according to claim 1, wherein said  
combining means weights the respective measured  
reception power of data to add the weighted reception  
power.

[Claim3] A base station apparatus comprising:  
25 modulating means for modulating a plurality of  
transmitting data to spread signals orthogonal to  
each other; and

transmitting means for transmitting said spread signals in parallel as radio signals from different antennas,

wherein said apparatus performs radio communications with the communication terminal apparatus as described in claim 1 or 2.

[Claim4] The base station apparatus according to claim 3, wherein said modulating means divides one transmitting data into a plurality of transmitting data and multiplies each of the plurality of transmitting data by respective one of spreading codes orthogonal to each other.

[Claim5] The base station apparatus according to claim 3, wherein said modulating means multiplies each of the plurality of transmitting data orthogonal to each other by the same spreading code.

[Claim6] A communication terminal apparatus comprising:

reception power measuring means for measuring reception power of a plurality of control signals whose fading states are independent of each other;

reception power combining means for combining the respective measured reception power of data; and

transmission power controlling means for controlling transmission power based on the combined reception power.

[Claim7] A base station apparatus comprising:

data dividing means for dividing transmitting data to amounts corresponding to the number of antennas;

spreading means for spreading each of divided  
5 data with a spreading code different from each other;  
and

transmitting means for transmitting the spread data in parallel from antennas different from each other, and transmitting a control signal different  
10 from each other from each of the antennas,  
wherein said base station apparatus performs radio communications with the communication terminal apparatus according to claim 6.

[Claim8] The base station apparatus according  
15 to claim 7, wherein said transmitting means constantly transmits a known signal different from each other on the same channel as the control signal from each of the antennas.

[Claim9] A transmission power control method  
20 wherein a plurality of spread signals orthogonal to each other is transmitted in parallel as a radio signal from different antennas at a base station apparatus side, while at a communication terminal side, received signals are despread using the same  
25 spreading code as used at the transmitting side, reception power is measured and combined, and transmission power is controlled based on the

combined reception power.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field of the Invention]

5       The present invention relates to a communication terminal apparatus, a base station apparatus, and a transmission power control method that perform open-loop transmission power control.

[0002]

10       [Prior Art]

CDMA (Code Division Multiple Access), which is one of multiple access of a radio transmission system, is a method for spreading a spectrum of an information signal to a sufficiently wide band as compared with  
15 an original information bandwidth to transmit the signal, and it is capable of increasing spectral efficiency highly, and accommodating numerous users.

[0003]

20       In CDMA, however, there is a near-far problem, specifically, in the case where a desired transmitting station is located at a far place and an undesired transmitting station (interference station) is located at a near place, reception power  
25 of a signal transmitted from the interference station becomes larger than reception power of a signal transmitted from the desired transmitting station,

and this makes it impossible to suppress cross-correlation between spreading codes by only processing gain to make it impossible to perform communications.

5           [0004]

Hence, a cellular system using CDMA needs transmission power control according to a state of each transmission channel on a reverse link. Moreover, in a terrestrial mobile communication,  
10 transmission power control for making compensation for a variation in a momentary value of reception power is needed as measures against fading, which is a cause of deteriorating channel quality.

[0005]

15           Herein, a duplex system in multiple access includes TDD (Time Division Duplex) and FDD (Frequency Division Duplex).

[0006]

TDD is a system that time-divides the same radio  
20 frequency into a reverse link and a forward link to perform communication, and the frequency correlation relating to fading variations between transmitting signal and received signal 1 since the transmission and reception are in the same band. Then,  
25 in the case where switching time between both is sufficiently short, since TDD has the high time correlation between transmission and reception

propagation path states such as fading variations and the like, it is possible to perform the open-loop transmission power control that controls transmission power based on reception power at a communication terminal.

[0007]

Also, in FDD that performs communications at different frequencies between the reverse link and the forward link, when the communication terminal originates a call using RACH (Random Access Channel), a transmission power value is determined by the open-loop transmission power control based on a transmission power value of a broadcast channel notified by the broadcast channel, an interference power value at a base station, a target power value at a base station reception end, and reception power of the broadcast channel.

[0008]

The following will explain the conventional CDMA base station and communication terminal that perform the open-loop transmission power control with reference to the drawings.

[0009]

FIG. 6 is a block diagram illustrating the configuration of the conventional base station. The base station illustrated in FIG. 6 comprises a modulator 11 for modulating transmitting data, a

spreader 12 for multiplying the modulated signal by spreading code A to spread, an antenna 13 for receiving and transmitting the signal, a desreader 14 for multiplying the received signal by spreading code B to despread , and a demodulator 15 for demodulating the despread signal.

[0010]

Transmitting data is modulated by the modulator 11 and the modulated data is spread by the spreader 12 using spreading code A, and the resultant is transmitted via the antenna 13.

[0011]

The signal received via the antenna 13 is subjected to desreading processing by the desreader 14 using spreading code B, and the despread signal is demodulated by the demodulator 15 to extract received data.

[0012]

FIG. 7 is a block diagram of the configuration of the conventional communication terminal. The communication terminal illustrated in FIG. 7 comprises an antenna 21 for receiving and transmitting a signal, a desreader 22 for multiplying the received signal by spreading code A to despread, a demodulator 23 for demodulating the despread signal, a reception power measuring section 24 for measuring a reception power value from the

demodulation result, a modulator 25 for modulating transmitting data, a spreader 26 for multiplying the modulated signal by spreading code B to spread, and transmission power controller 27 for performing  
5 transmission power control based on the reception power value and the like.

[0013]

Herein, the reception power measuring section 24 provides average processing to the measured  
10 reception power value in order to suppress the momentary variation of the reception power value caused by fading and the like, and outputs the reception power average value to the transmission power controller 27.

15 [0014]

The signal received via the antenna 21 is subjected to despreading processing by the despreader 22 using spreading code A, and the despread signal is demodulated by the demodulator 23, so that  
20 received data is extracted and the demodulation result is outputted to the reception power measuring section 24. Then, reception power is measured from the demodulation result by the reception power measuring section 24, the measurement result is  
25 inputted to the transmission power controller 27, and a transmission power value is determined by the transmission power controller 27 based on the

reception power value and the like.

[0015]

Transmitting data is modulated by the modulator 25, and the modulated data is subjected to spreading processing by the spreader 26 using spreading code B. The power is amplified by the transmission power controller 27 based on the determined transmission power value, and the resultant is transmitted as a radio signal from the antenna 21.

10 [0016]

In this way, according to the conventional radio transmission system, the base station transmits a signal from one antenna, and the communication terminal performs the open-loop transmission power control based on the reception power of the received signal.

[0017]

[Problems to be Solved by the Invention]

However, since the communication terminal of the conventional radio transmission system provides average processing to the measured reception power value, it takes much time to suppress the momentary variation to calculate a high accurate reception power average value when the fading variation is slow, and this causes a problem in which the open-loop transmission power control cannot be performed at high speed and with high accuracy.

[0018]

In view of the foregoing, the present invention has been carried out. It is an object of the present invention to provide a communication terminal apparatus, a base station apparatus, and a transmission power control method that are capable of calculating a reception power average value at high speed and with high accuracy, and are capable of performing open-loop transmission power control at high speed and with high accuracy, even when a fading variation is slow.

[0019]

[Means for Solving the Problem]

A communication terminal apparatus of the present invention adopts a configuration provided with despreading means for despreading each of a plurality of received signals orthogonal to each other, reception power measuring means for measuring reception power of the respective despread data, reception power combining means for combining the respective measured reception power of data, and transmission power controlling means for controlling transmission power based on the combined reception power.

[0020]

According to this configuration, since it is possible to measure the reception power of a plurality

of signals which are orthogonal to each other and are transmitted from different antennas at a base station side and of which the fading states are indecent of each other, it is possible to reduce  
5 the time which lapses before the momentary variation is suppressed and to perform the open-loop transmission power control at high speed and with high accuracy even when the fading variation is slow.

[0021]

10 The communication terminal apparatus of the present invention adopts a configuration where the combining means weights the respective measured reception power of data to add the weighted reception power.

15 [0022]

According to this configuration, it is possible to control the transmission power with more accuracy than the case where the transmission power control is performed simply using the sum of reception power  
20 of data.

[0023]

A base station apparatus of the present invention adopts a configuration provided with modulating means for modulating a plurality of  
25 transmitting data to spread signals orthogonal to each other, and transmitting means for transmitting the spread signals in parallel as radio signals from

different antennas, to perform radio communications with the above-mentioned communication terminal apparatus.

[0024]

5       The base station apparatus of the present invention adopts a configuration where the modulating means divides one transmitting data into a plurality of transmitting data and multiplies each of the plurality of transmitting data by respective  
10 one of spreading codes orthogonal to each other.

[0025]

      The base station apparatus of the present invention adopts a configuration where the modulating means multiplies each of the plurality  
15 of transmitting data orthogonal to each other by the same spreading code.

[0026]

      According to these configurations, since it is possible to transmit signals orthogonal to each other  
20 from different antennas, it is possible for a communication terminal to measure reception power of a plurality of received signals whose fading states are independent of each other, to reduce the time which lapses before the momentary variation is suppressed,  
25 and to perform the open-loop transmission power control at high speed and with high accuracy even when the fading variation is slow.

[0027]

A communication terminal apparatus of the present invention adopts a configuration provided with reception power measuring means for measuring  
5 reception power of a plurality of control signals whose fading states are independent of each other, reception power combining means for combining the respective measured reception power of data, and  
transmission power controlling means for  
10 controlling transmission power based on the combined reception power.

[0028]

According to this configuration, since the quality can be improved due to the diversity effect  
15 and the transmission power of the control signal is fixed, the communication terminal apparatus does not need to obtain information indicative of the transmission power from the base station apparatus during communications, and is capable of reducing  
20 a computation amount.

[0029]

A base station apparatus of the present invention adopts a configuration provided with data  
dividing means for dividing transmitting data to  
25 amounts corresponding to the number of antennas, spreading means for spreading each of divided data with a spreading code different from each other, and

transmitting means for transmitting the spread data  
in parallel from antennas different from each other,  
and transmitting a control signal different from each  
other from each of the antennas,  
5 wherein the base station apparatus performs radio  
communications with the above-mentioned  
communication terminal apparatus.

[0030]

The base station apparatus of the present  
10 invention adopts a configuration where the  
transmitting means constantly transmits a known  
signal different from each other on the same channel  
as the control signal from each of the antennas.

[0031]

15 According to these configurations, in the  
communication terminal apparatus, it is possible to  
improve the quality due to the diversity effect.  
Further, since the transmission power of the control  
signal is fixed, it is not necessary to transmit the  
20 information indicative of the transmission power to  
the communication terminal during communications,  
and it is possible to reduce a computation amount  
in the communication terminal apparatus.

[0032]

25 In a transmission power control method of the  
present invention, a plurality of spread signals  
orthogonal to each other is transmitted in parallel

as a radio signal from different antennas at a base station apparatus side. Then, at a communication terminal apparatus side, received signals are despread using the same spreading code as used at  
5 the transmitting side, the reception power is measured and combined, and transmission power is controlled based on the combined reception power.

[0033]

According to this method, the signals, which  
10 are orthogonal to each other, are transmitted from the different antennas at the base station side, and reception power of the plurality of received signals whose fading conditions are independent of each other is measured at the communication terminal side. This  
15 makes it possible to reduce the time which lapses before the momentary variation is suppressed, and to perform the open-loop transmission power control at high speed and with high accuracy even when the fading variation is slow.

20 [0034]

[Embodiments of the Invention]

It is a gist of the present invention that at a base station side, a plurality of spread signals orthogonal to each other is transmitted in parallel  
25 as a radio signal from different antennas, and that at a communication terminal side, respective reception power of received signals is measured and

combined, and transmission power is controlled based on the combined reception power.

[0035]

Each embodiment of the present invention will  
5 be described below in detail with reference to accompanying drawings.

[0036]

(First Embodiment)

FIG. 1 is a block diagram illustrating the  
10 configuration of the base station according to the first embodiment of the present invention. Additionally, in the following explanation, it is assumed that the number of transmission sequences of the base station is 2 in order to simplify the  
15 explanation.

[0037]

In the base station illustrated in FIG. 1, a data divider 101 divides transmitting data to the amounts corresponding to the number of antennas. A  
20 data dividing method includes a method for dividing data by serial/parallel conversion or a method for simply dividing data in order for the same data to be transmitted from each antenna, and the like.

[0038]

25 A modulator 102 and a modulator 103 modulate transmitting data divided and a spreader 104 multiplies the modulated signal by spreading code

A1 to spread . A spreader 105 multiplies the modulated signal by spreading code A2 to spread . Here, spreading code A1 and spreading code A2 are codes, which are orthogonal to each other. Multiplication  
5 of signals by the spreading codes, which are orthogonal to each other, establishes the relationship in which an output signal of the spreader 104 and an output signal of the spreader 105 are orthogonal to each other.

10 [0039]

An antenna 106 transmits the output signal of the spreader 104 as a radio signal, and an antenna 107 transmits the output signal of the spreader 105 as a radio signal. Also, the antenna 106 and the  
15 antenna 107 receive the signals transmitted from the communication terminal.

[0040]

A desreader 108 multiplies the received signal by spreading code B to despread, and a demodulator  
20 109 demodulates the despread signal and extracts received data.

[0041]

An explanation will be next given of the flow of the signals transmitted and received at the base  
25 station of FIG. 1. Transmitting data is divided to the amounts corresponding to the plurality of antennas and modulated by the modulator 102 and the

modulator 103, and the modulated data is inputted into the spreader 104 and the spreader 105. Then, the spreader 104 and the spreader 105 spread respective divided data using spreading code sequences, which are orthogonal to each other.

[0042]

The spread signals are transmitted in parallel from the antenna 106 and the antenna 107. In addition, radio signals transmitted in parallel from the different antennas are subjected to the fading variations, which are independent of each other.

[0043]

The signals received by the antenna 106 and the antenna 107 are subjected to despreading processing by the despreader 108 using spreading code B. The despread signals are demodulated by the demodulator 109, so that received data is extracted.

[0044]

An explanation will be next give of the configuration of the communication terminal according to this embodiment with reference to the block diagram illustrated in FIG. 2.

[0045]

As the communication terminal illustrated in FIG. 2, an antenna 201 transmits a signal as a radio signal, and receives a signal transmitted from the base station. A despreader 202 and a despreader 203

multiply the received signals by the same codes as spreading code A1 and spreading code A2 used in the transmitting side to despread, respectively. A demodulator 204 demodulates the signals despread with spreading code A1 and a demodulator 205 demodulates the signals despread with spreading code A2, and a data configuring section 206 configures demodulated data back to the pervious data format to which no data division is subjected.

10 [0046]

A reception power measuring section 207 measures reception power from the demodulation result of the demodulator 204, and averages them. A reception power measuring section 208 measures reception power from the demodulation result of the demodulator 205, and averages them. It is noted that a reception power measuring section 207 and a reception power measuring section 208 generally measure reception power of a known signal portion such as a Pilot Symbol, a Midamble, and the like.

[0047]

A reception power combiner 209 combines the reception power average values calculated by the reception power measuring sections 207 and the reception power measuring section 208. The method for combining reception power includes a simply calculating method, a method for weighting the

respective reception power and adding them thereafter, and the like. In the case of weighting the respective reception power and adding them thereafter, transmission power can be controlled  
5 accurately as compared with the case of using the value obtained by simply adding the reception power of the respective data.

[0048]

A modulator 210 modulates transmitting data.  
10 A spreader 211 multiplies the modulated signal by spreading code B to spread. A transmission power controller 212 determines a transmission power value  $P_{UE}$ , which is given by the following expression (1), based on the combined reception power average value  
15 and the like, and amplifies power of the transmitting signal to the corresponding transmission power value.

[0049]

In the expression (1),  $L_p$  is a propagation loss,  
20 which is a difference between the transmission power value of the base station and the reception power average value combined by the reception power combiner 209,  $I_{BTS}$  is an interference power value at the base station, and C is a constant. Additionally,  
25 the value of C is taught to the communication terminal apparatus from the base station apparatus via a layer 3.

(Expression 1)

$$P_{UE} = L_p + I_{BTS} + C \quad \dots (1)$$

[0050]

An explanation will be next given of the flow  
5 of the signal transmitted and received at the  
communication terminal of FIG. 2. The signal  
received by the antenna 201 is subjected to  
despreading processing with spreading code A1 at  
the despreader 202, and is subjected to despreading  
10 processing with spreading code A2 at the despreader  
203. The signal despread with spreading code A1 is  
demodulated by the demodulator 204, and the  
demodulation result is inputted to the reception  
power measuring section 207. The signal despread  
15 with spreading code A2 is demodulated by the  
demodulator 205, and the demodulation result is  
inputted to the reception power measuring section  
208. The data configuring section 206 configures  
demodulated data back to the pervious data format  
20 to which no data division is subjected, obtaining  
received data.

[0051]

Moreover, reception power is measured by the  
reception power measuring section 207 based on the  
25 demodulation result of the demodulator 204,  
reception power is measured by the reception power  
measuring section 208 based on the demodulation

result of the demodulator 205, and the measurement results of the receptive reception power are inputted to the reception power combiner 209.

[0052]

5        Then, the respective reception power values are combined by the reception combiner 209, and the transmission power controller 212 determines a transmission power value based on the combined reception power, the transmission power value of the  
10 base station, and the target reception power value at the base station.

[0053]

Transmitting data is modulated by the modulator 210, and the modulated data is subjected to  
15 despread processing at the spreader 211 with spreading code B. Then, the despread transmitting signal is amplified to the corresponding transmission power value by the transmission power controller 212, and the resultant is transmitted as  
20 a radio signal from the antenna 201.

[0054]

Thus, since a signal is transmitted from different antennas at a base station side, a plurality of signals whose fading states are independent of  
25 each other can be received to be combined at a communication terminal side, whereby it is possible to improve the quality due to the diversity effect.

[0055]

Further, at the communication terminal side, reception power of a plurality of signals whose fading states are independent of each other is measured, and based on the combined reception power value, the open-loop transmission power control is performed. Therefore, it is possible to perform the transmission power control with high accuracy taking paths into account, and to decrease the control error.

10 [0056]

Furthermore, at the base station side signals orthogonal to each other are transmitted from different antennas, it is thereby possible to reduce the time which lapses before the momentary variation is suppressed.

[0057]

In addition, this embodiment has used the method in which the transmitting signals are multiplied by respective spreading codes orthogonal to each other in order to explain the method for making the transmitting signals orthogonal to each other. The present invention, however, can obtain the same effectiveness by making the transmitting signals orthogonal to each other using the other method, for example, in which the transmitting signals orthogonal to each other are multiplied by the same spreading code.

[0058]

(Second Embodiment)

In order for a communication terminal to perform the open-loop transmission power control, the terminal needs to recognize the transmission power of a base station. Since the transmission power of control signals on BCH (Broadcast Channel), PCH (Paging Channel) and FACH (Forward Link Access Channel) is fixed, it is not necessary to obtain information indicative of the transmission power from the base station during communications.

[0059]

In other words, the communication terminal measures the reception power of the control signals to perform the open-loop power transmission control, and is thereby capable of reducing a computation amount. In the second embodiment a case will be described where a base station with two transmission sequences transmits two kinds of control signals from different antennas.

[0060]

FIG.3 is a block diagram illustrating the configuration of the base station apparatus according to the second embodiment. In addition, in the base station illustrated in FIG.3, sections common to the base station in FIG.1 are assigned the same reference numerals as in FIG.1 to omit

descriptions thereof.

[0061]

A spreader 301 multiplies a first control signal by spreading code A3 to spread, and a spreader 302  
5 multiplies a second control signal by spreading code A4 to spread.

[0062]

The antenna 106 transmits a radio signal obtained by multiplexing the output signal of the  
10 spreader 104 and the output signal of the spreader 301, and the antenna 107 transmits a radio signal obtained by multiplexing the output signal of spreader 105 and the output signal of spreader 302. Further, the antennas 106 and 107 receive signals  
15 transmitted from the communication terminal.

[0063]

FIG.4 is a block diagram illustrating the configuration of the communication terminal according to this embodiment. In addition, in the  
20 communication terminal illustrated in FIG.4, the sections common to the communication terminal apparatus in FIG.2 are assigned the same reference numerals as in FIG.2 to omit descriptions thereof.

[0064]

25 A desreader 401 and a desreader 402 multiply the received signal by the respective same codes as spreading code A3 and spreading code A4 used on the

transmitting side to despread.

[0065]

The reception power measuring section 207 measures reception power from the despread result of the desreader 401, and averages them. The reception power measuring section 208 measures reception power from the despread result of the desreader 402, and averages them.

[0066]

FIG.5 is a diagram to explain a signal configuration on a radio transmission path according to this embodiment.

[0067]

Here, control signals include one on BCH or PCH which is transmitted constantly, and another one on FACH which is transmitted intermittently. In addition, the FACH signal is transmitted in response to an access request on RACH transmitted from a communication terminal apparatus.

[0068]

FIG.5 illustrates a case where first control signal 501 is the signal (for example, on BCH) which is constantly transmitted, and second control signal 502 is the signal (for example, on FACH) which is transmitted intermittently.

[0069]

As illustrated in FIG.5, from the antenna 106

a multiplexed signal of Dedicated Channel (DCH) signal 501 and first control signal (CCH1) 502 is transmitted, and from the antenna 107 a multiplexed signal of dedicated channel signal (DCH) 503 and  
5 second control signal (CCH2) 504 is transmitted.

[0070]

Then, Dedicated Channel signal 501 is transmitted with midamble 511, and first control signal 502 is transmitted with midamble 512.  
10 Further, Dedicated Channel signal 503 is transmitted with midamble 513, and second control signal 504 is transmitted with midamble 514.

[0071]

Here, in order to maintain the received quality,  
15 it is preferable to perform the open-loop transmission power control constantly for each slot. However, when the control signal is transmitted intermittently, it is not possible to perform the open-loop transmission power control during an  
20 interval the control signal is not transmitted.

[0072]

Then, as illustrated in FIG.5, on a slot on which second control signal 504 is not transmitted, only midamble 514 is transmitted. Therefore, even when  
25 the control signal is transmitted intermittently, it is possible to perform the open-loop transmission power control constantly for each slot and to maintain

the received quality.

[0073]

Thus, reception power of a plurality of control signals whose fading states are independent of each other is measured at a communication terminal side, and based on the combined reception power value, the open-loop transmission power control is performed. In this case, since the transmission power of the control signal is fixed, the communication terminal does not need to obtain information indicative of the transmission power from a base station during communications, and is capable of reducing a computation amount.

[0074]

In addition, in this embodiment BCH, PCH and FACH are described as examples of control signal, but control signals in actual communications are not limited to the foregoing, and it may be possible in the present invention to use another control signal to perform the open-loop transmission power control.

[0075]

Further, in this embodiment the case is described where midamble is transmitted on each slot, but the present invention is not limited to the above case. It may be possible to obtain the same effectiveness by transmitting a signal known between transmitting and receiving sides on each slot.

[0076]

[Effects of the Invention]

As described above, according to the present invention, the signals, which are orthogonal to each other, are transmitted from the different antennas at the base station side, and reception power of a plurality of received signals whose fading states are independent of each other is measured at the communication terminal side. This makes it possible to reduce the time which lapses before the momentary variation is suppressed, and to perform the open-loop transmission power control at high speed and with high accuracy even when the fading variation is slow.

[Brief Description of Drawings]

15 [FIG. 1]

A block diagram illustrating the configuration of a base station according to the first embodiment of the present invention;

[FIG. 2]

20 A block diagram illustrating the configuration of a communication terminal according to the above embodiment;

[FIG. 3]

25 A block diagram illustrating the configuration of a base station according to the second embodiment of the present invention;

[FIG. 4]

A block diagram illustrating the configuration of a communication terminal according to the above embodiment;

[FIG. 5]

5 A diagram to explain a signal configuration on a radio transmission path according to the above embodiment;

[FIG. 6]

A block diagram illustrating the configuration  
10 of the conventional base station; and

[FIG. 7]

A block diagram illustrating the configuration of the conventional communication terminal.

[BRIEF DESCRIPTION OF THE SYMBOLS]

15 101 Data divider  
102, 103 Modulator  
104, 105 Spreader  
106, 107 Antenna  
108 Despreader  
20 109 Demodulator  
201 Antenna  
202, 203 Despreader  
204, 205 Demodulator  
206 Data configuring section  
25 207, 208 Reception power measuring section  
209 Reception power combiner  
210 Modulator

211 Spreader

212 Transmission power controller

[Name of Document] ABSTRACT

[Abstract]

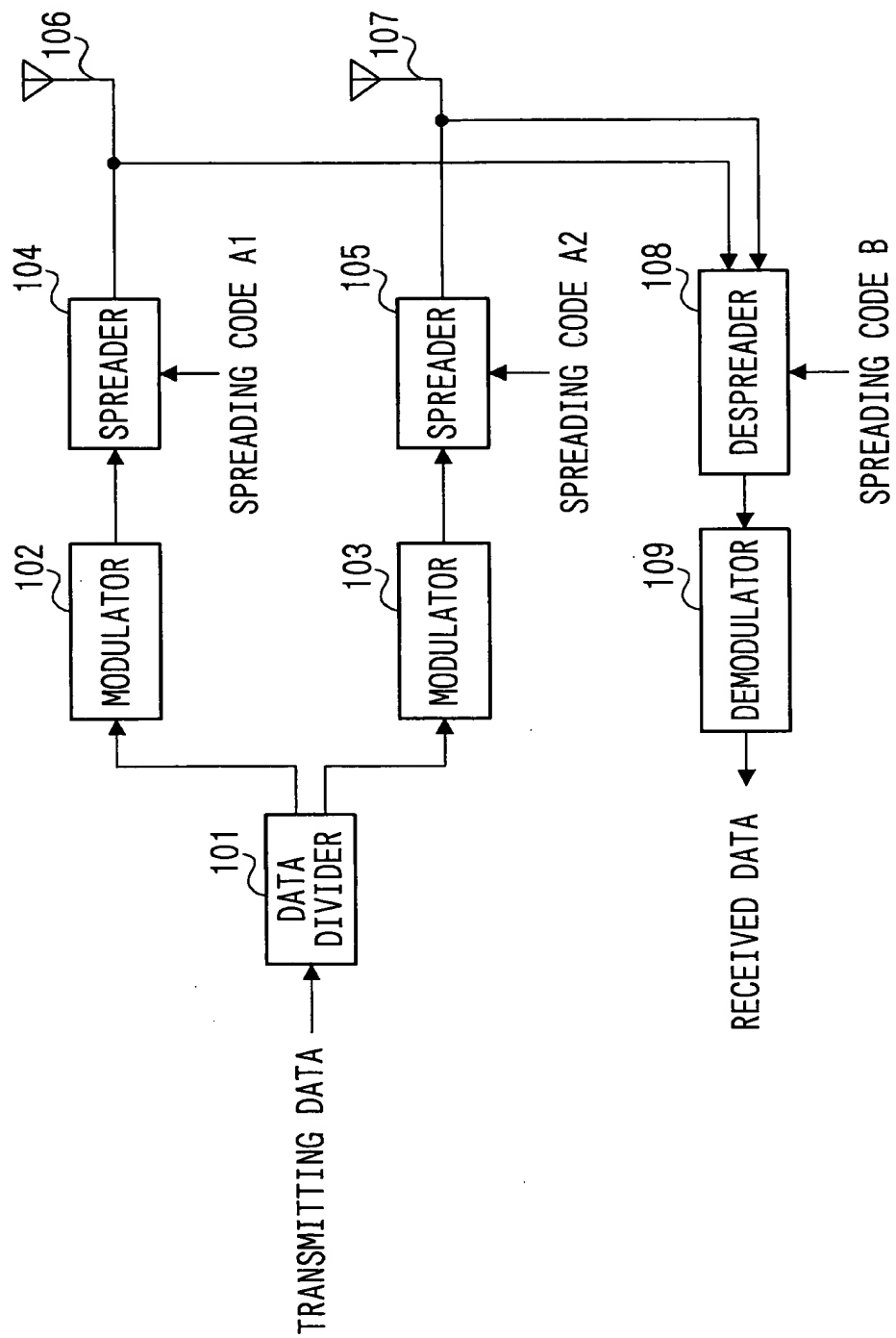
[Object] To perform open-loop transmission power control with high speed and with high accuracy  
5 even when fading variation is slow.

[Overcoming Means] An antenna 201 receives signals orthogonal to each other transmitted from different antennas of a base station, a despreaders 202 and a despreaders 203 perform despreading on the  
10 received signals with the respective same codes as spreading codes used in the base station, a demodulator 204 and a demodulator 205 demodulate despread signals, a reception power measuring section 207 and a reception power measuring section 208  
15 measure reception power from the demodulation results, a reception power combiner 209 combines the measured reception power, and based on the combined reception power, transmission power controller 212 controls the transmission power.

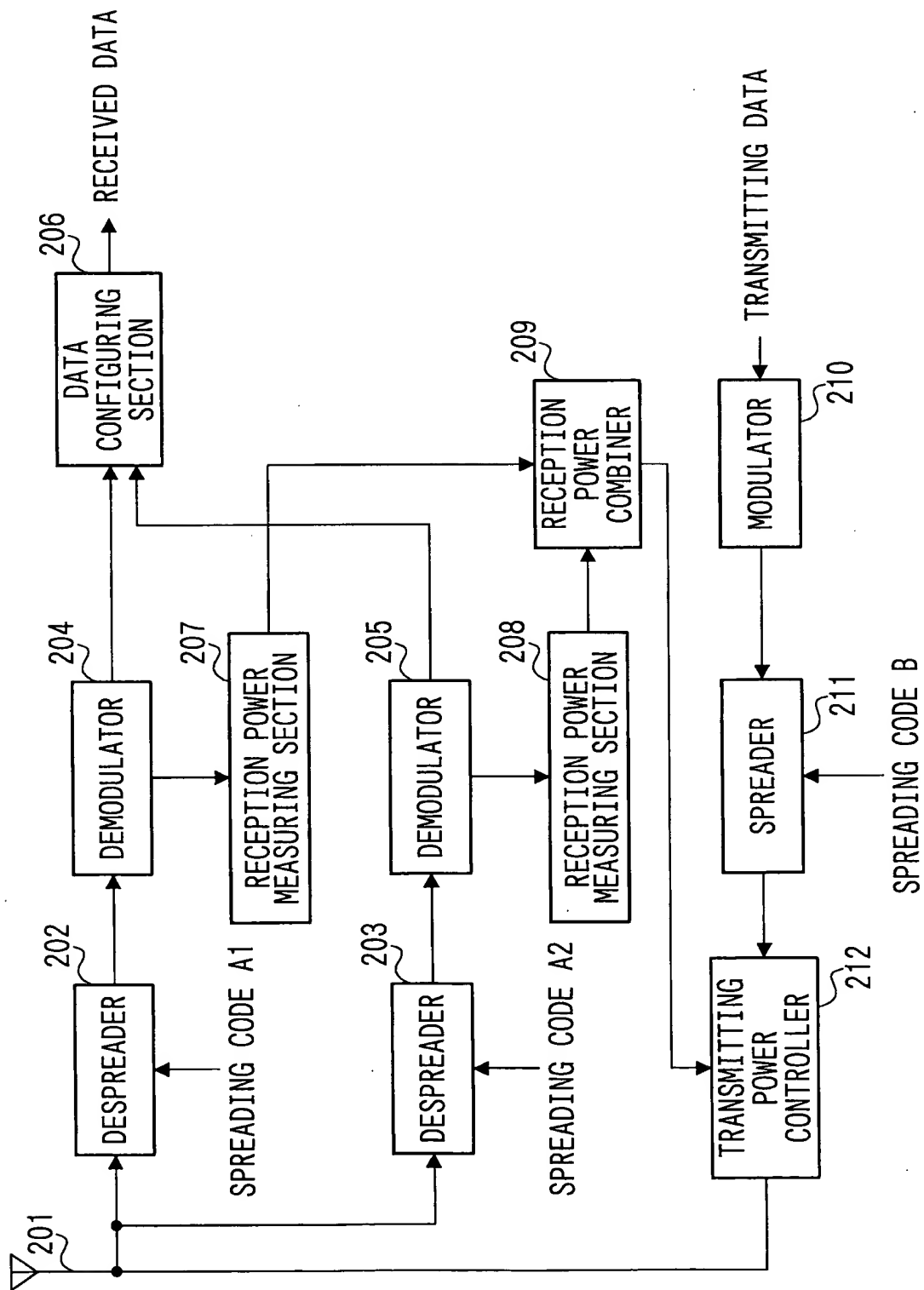
20 [Selected Drawing] FIG.2

[NAME OF DOCUMENT] DRAWINGS

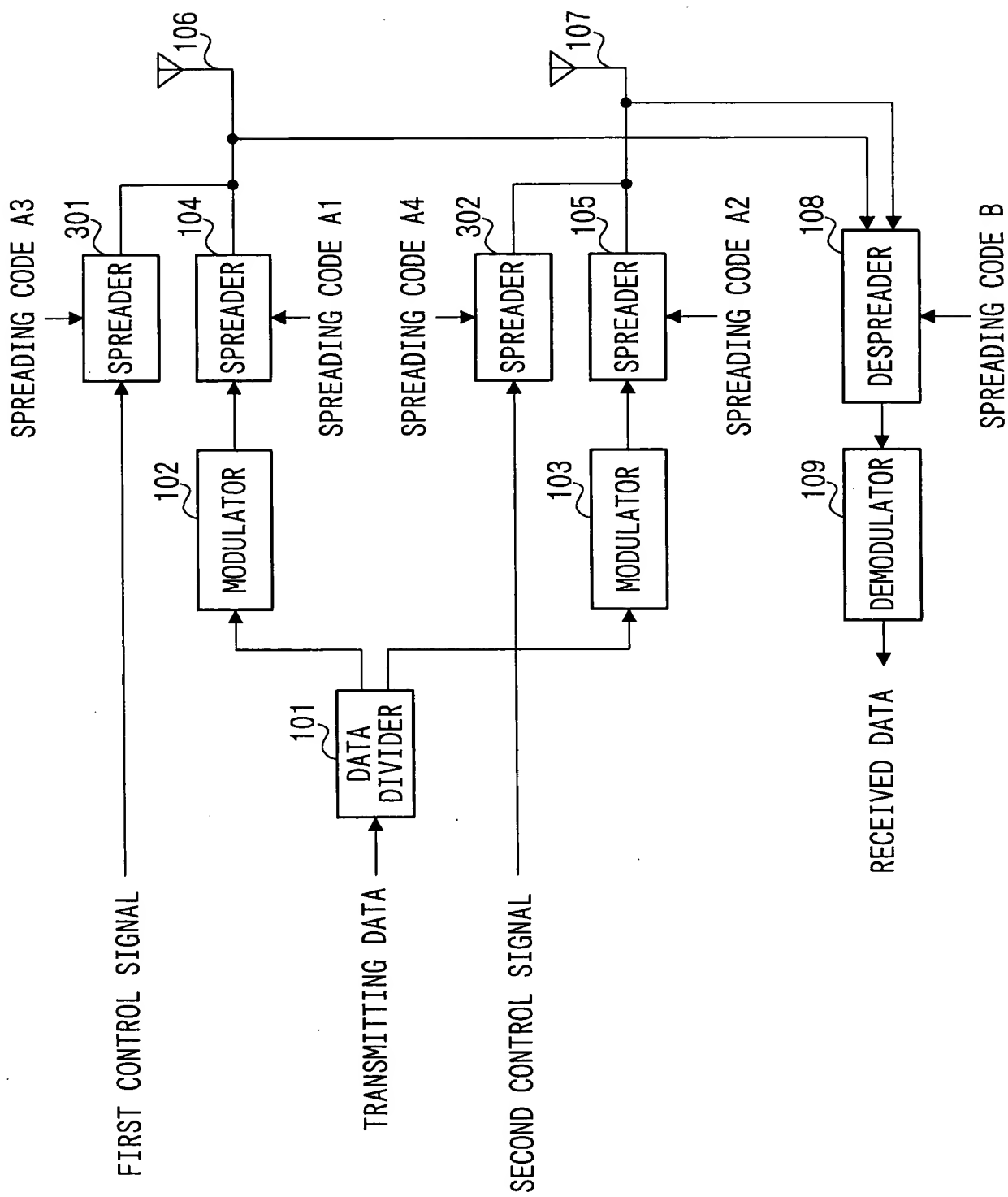
[FIG.1]



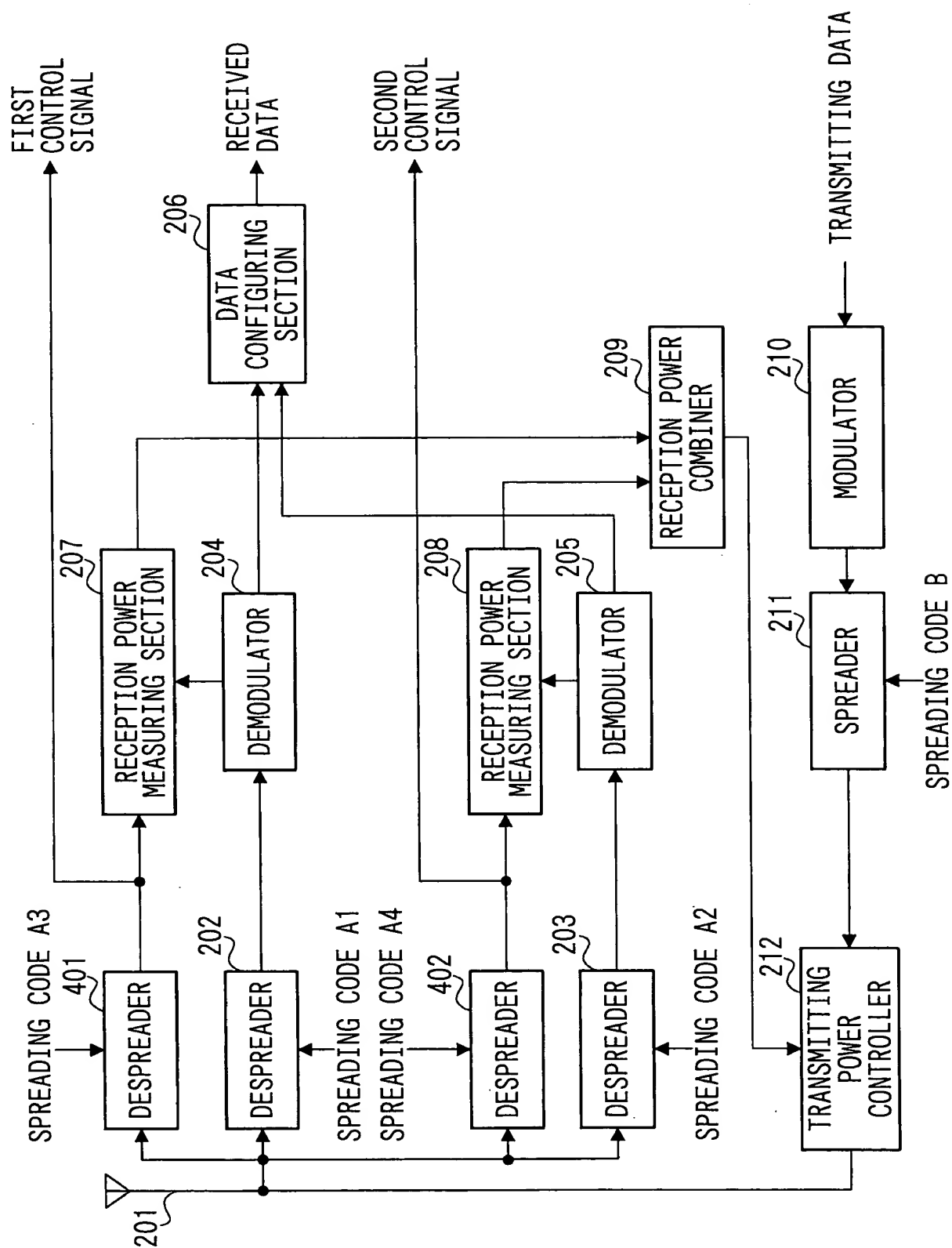
[FIG.2]



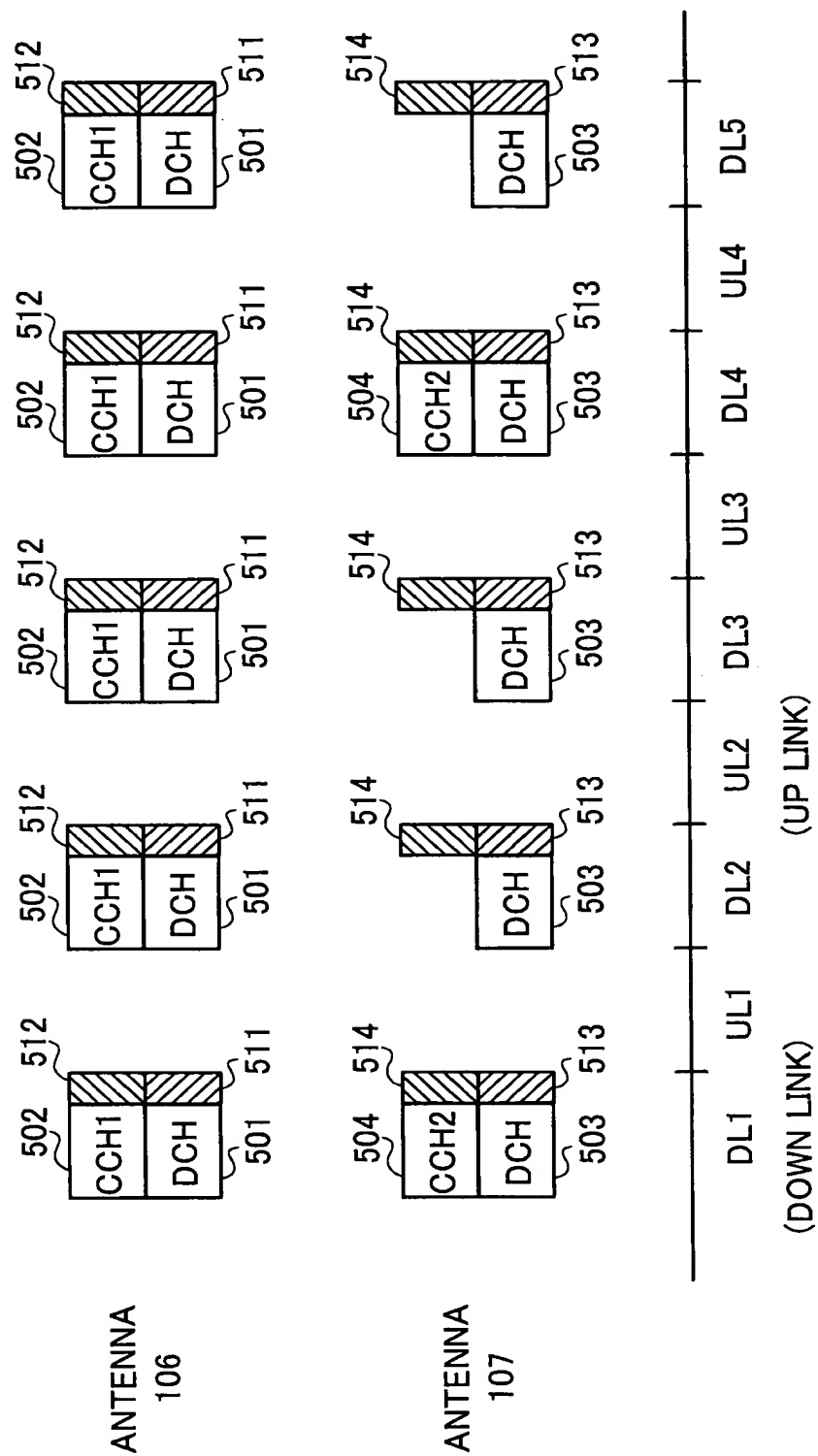
[FIG.3]



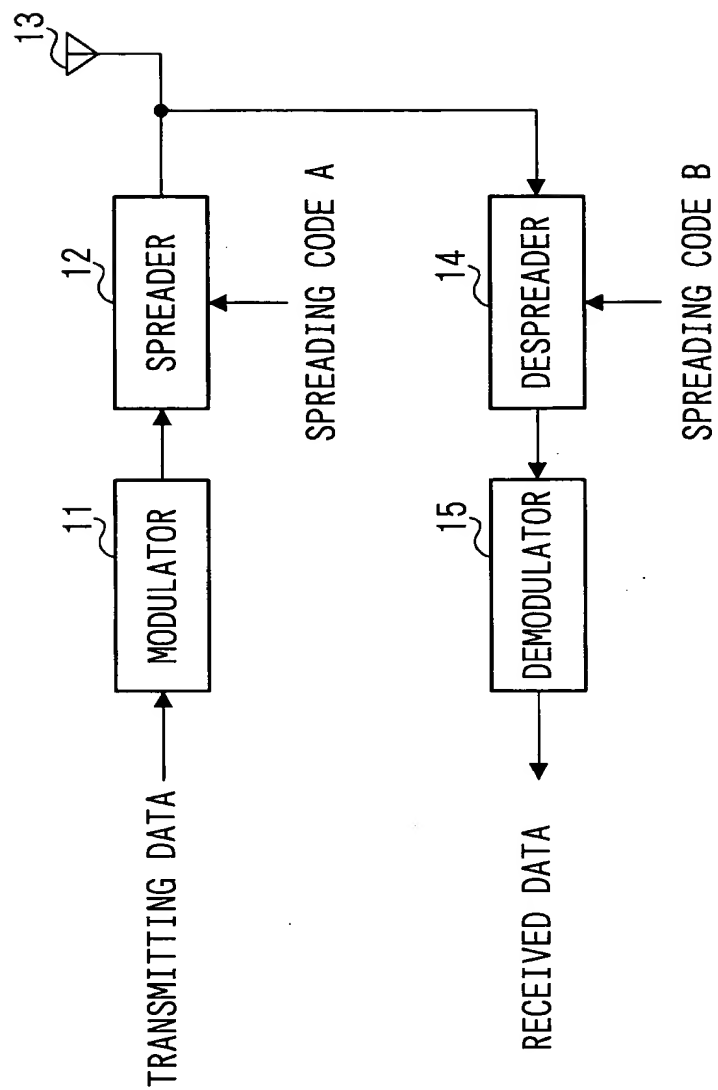
[FIG. 4]



[FIG.5]



[FIG.6]



[FIG.7]

